Interactive Analysis Environment of Unified Accelerator Libraries

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Abstract

Unified Accelerator Libraries (UAL,http://www.ual.bnl.gov) software is an open accelerator simulation environment addressing a broad spectrum of accelerator tasks ranging from online-oriented efficient models to full-scale realistic beam dynamics studies. The paper introduces a new package integrating UAL simulation algorithms with the Qt-based Graphical User Interface and an open collection of analysis and visualization components. The primary user application is implemented as an interactive and configurable Accelerator Physics Player whose extensibility is provided by plug-in architecture. Its interface to data analysis and visualization modules is based on the Qt layer (http://root.bnl.gov) developed and supported by the Star experiment. The present version embodies the ROOT (http://root.cern.ch) data analysis framework and Coin 3D (http://www.coin3d.org) graphics library.

Outline

- **Unified Accelerator Libraries**
  - Architecture
  - Element-Algorithm-Probe Framework
  - API interface
- **Interactive Analysis Extension**
  - Architecture
  - Accelerator Physics Player
  - Collection of Accelerator-specific viewers
- **Status and applications**

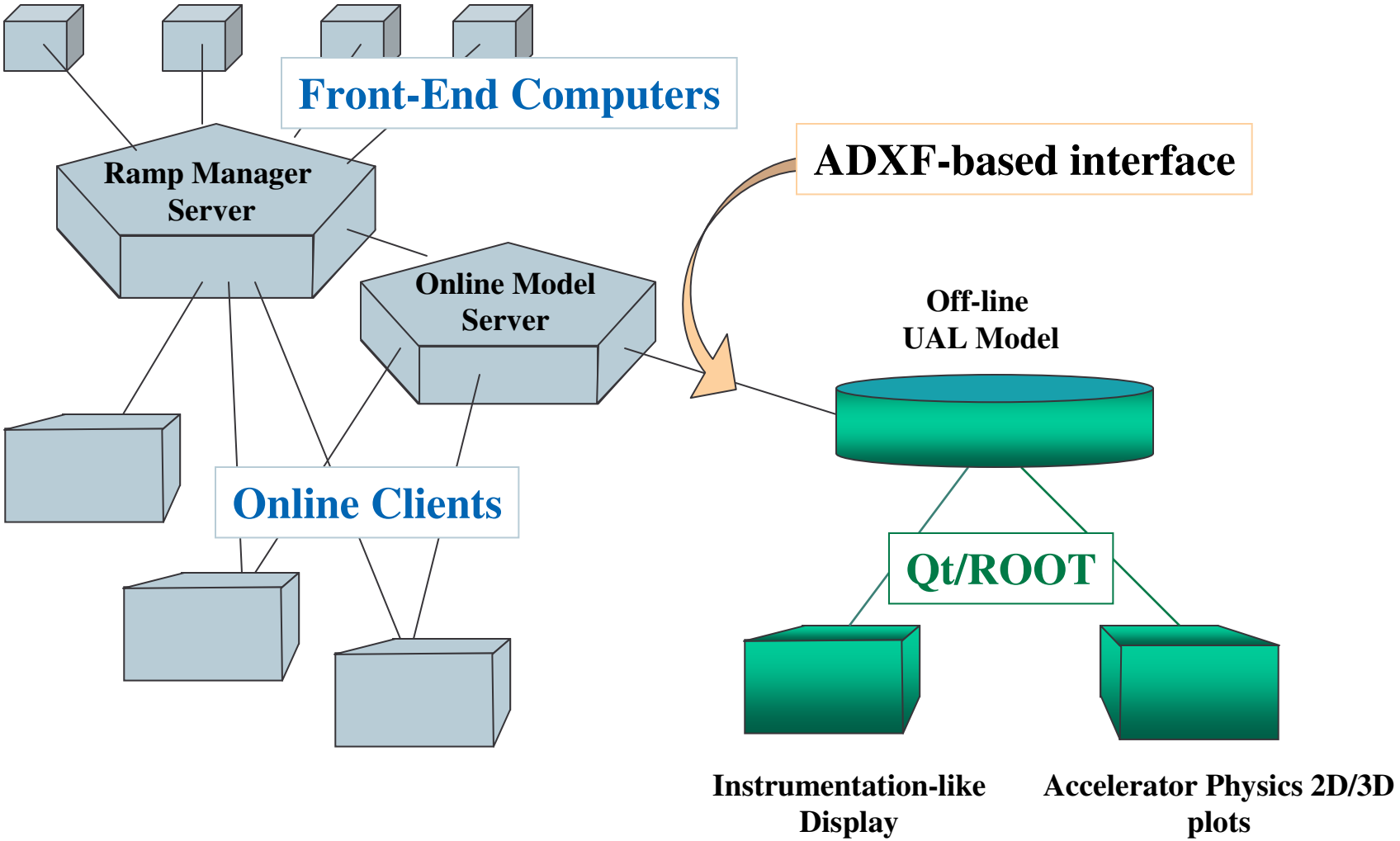
UAL Interactive Analysis Extension

Objectives

- Bring the UAL off-line applications to the RHIC online environment for analyzing accelerator physics experiments and operational data.
- Facilitate modeling and analysis of multi-particle applications, such as beam-beam and space charge effects, instabilities, cooling, *etc*.)

RHIC Joined Online and Off-line modeling environment

PAC 2005

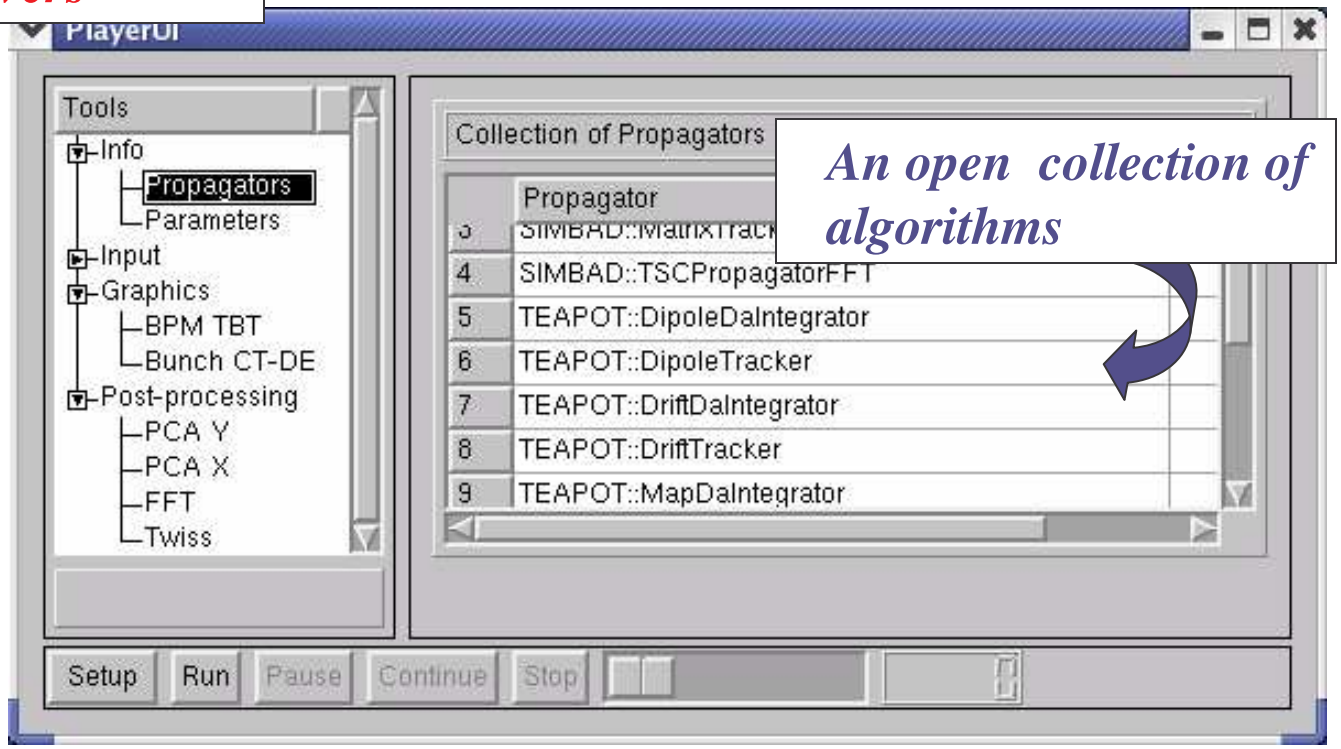


Accelerator Physics Player

```
UAL::USPAS::BasicPlayer* player = new     UAL::USPAS::BasicPlayer();
player->setShell(&shell);

qApp.setMainWidget(player);
player->show();
qApp.exec();
```

An open collection of viewers



An open collection of algorithms

Status and Applications

Framework of the UAL Interactive Analysis Environment has been implemented and is currently developed as a part of:

- RHIC joined online and off-line modeling environment
  http://www.sns.gov/pac05
- Particle Accelerator School course, Cornell, June 20-24, 2005
  http://uspas.fnal.gov/programs/cornell/AccelSimulation.htm

The new version 1.11 is expected next month and will be available from the UAL web site: **http://www.ual.bnl.gov.**

Accelerator Propagator Description Format (APDF)

- APDF file is a XML representation of the accelerator propagator (The Algorithm Concept)
- Its schema is under development.

Applications range from small special tasks to full-scale realistic beam dynamics studies

Simple matrix-based tracker

simple.apdf

```
<apdf>
 <propagator  name="simple"  accelerator="blue" >
   <link algorithm="TIBETAN::SectorTracker"
                 sector = "Default" />
    <link algorithm="TIBETAN::RFCavityTracker"
                 elements="rfac1" />
    <link algorithm="TIBETAB::WCMonitor"
                 elements="mend" />
  </propagator>
</apdf>
```

Element-by-Element tracker for Model Independent Analysis studies

mia.apdf

```
<apdf>
 <propagator  name="mia"  accelerator="blue">
   <link algorithm="TEAPOT::DriftTracker"
          types = "Default" />
    <link algorithm="TEAPOT::DriftTracker"
          types="Marker|Drift|[VH]monitor|Monitor" />
    <link algorithm="TEAPOT::DipoleTracker"
          types="SBend" />
    <link algorithm="TEAPOT::MltTracker"
          types="Quadrupole|Sextupole|Multipole|Kicker" />
    <link algorithm="TIBETAN::RFCavityTracker"
          types="RfCavity" />
    <link algorithm="AIM::Monitor"
          types="Monitor" />
     ....
  </propagator>
</apdf>
```